USGS science for a changing world
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

DESCRIPTION OF MAP UNITS

af **Artificial fill (Holocene)**--Mine dump associated with open-pit iron or talc mines

ag **Agriculture areas (Holocene)**

Qa **Alluvium (Holocene)**--Unconsolidated sand and gravel in stream and fan deposits

Qs **Eolian sand (Holocene)**

Qo **Older alluvium (Pleistocene)**--Elevated and dissected alluvium including fanglomerate, talus, and stream terrace deposits. Oldest fanglomerate deposits may be synchronous with fanglomerate facies of the China Ranch beds

Qp **Playa deposits (Pleistocene)**--Elevated and dissected horizontal silt, mud, and sand beds that interfinger with older alluvium. R.E. Reynolds (personal commun., 1985) reported Irvingtonian to Rancholabrean (0-1.5 Ma; Berggren and others, 1985) camel, horse, and mammoth fauna in playa deposits along the southeastern edge of the map. Playa deposits in California Valley were mapped as upper Pleistocene lacustrine siltstone by Wright (1974)

Tfc **Fanglomerate facies of the China Ranch beds (upper Miocene)**--Boulder and cobble conglomerate with clasts derived from Tertiary and older rocks including megabreccia clasts from the Crystal Spring Formation (Tfcc), Kingston Peak Formation (Tfck), diabase (Tfcd), and volcanic rocks in Kingston Wash (Tfcv). This is the oldest Tertiary formation to contain clasts of the granite of Kingston Peak. Mapped by Wright (1954) in the western Alexander Hills as the fanglomerate lithofacies of the upper Miocene (Scott, 1985) China Ranch beds of Mason (1948)

Sedimentary and volcanic rocks of Kingston Wash (middle Miocene)--Approximately 350 m of fanglomerate, lacustrine, and volcanic rocks divided into:

Tkwc Chaotic sedimentary breccia of volcanic and lacustrine rocks

Tkwb Volcanic breccia with mafic clasts to 15 cm. An olivine basalt clast from this unit yields a whole-rock K-Ar age of 11.1 Ma

Tkwl Lacustrine rocks--Sandstone with laminated mudstone and siltstone interbeds, tuffaceous mudstone, and laminated mudstone

Tkwv Volcanic rocks--Basaltic to rhyodacite breccia as well as basaltic andesite, andesite porphyry, and rhyodacite flows. An andesite porphyry flow within this unit is characterized by a well-developed magmatic foliation, expressed by plagioclase phenocrysts up to 4 mm long, and by pillow structures near its contact with lacustrine deposits. Biotite from this flow yields an anomalous K-Ar age of 13.9 Ma (Bell, 1971). Plagioclase from rhyodacite breccia near the base of this unit yields a K-Ar age of 11.6 Ma

Tkws Sedimentary rocks--Lacustrine mudstone, tuffaceous siltstone, sandstone, and discontinuous limestone lenses

Tkwf Fanglomerate deposits--Cobbles and(or) breccia of quartzite and the Bonanza King Formation. This unit and sedimentary rocks described above (Tkws) are equivalent to ca. 13.0 Ma sedimentary rocks in the Shadow Valley basin just south of the Kingston Range (Friedmann, 1993)

Resting Springs Formation (middle Miocene)--Sedimentary and volcanic rocks in the northern half of the Kingston Range that consist of:

Trvb Volcanic breccia--Subangular to rounded boulders and cobbles of andesite, basalt, and latite in a calcareous tuff matrix. Groundmass feldspar and biotite from andesite flow breccias near the top of this unit yield concordant K-Ar ages of 12.5 (D.H. Hambrick, written commun., 1988) and 12.1 Ma, respectively. Biotite from a latite clast near the base of this unit yields a K-Ar age of 13.3 Ma (D.H. Hambrick, written commun., 1988)

Trv Volcanic rocks--Andesite, basalt, and latite flows including a foliated andesite porphyry flow with the same texture as an andesite porphyry flow in Kingston Wash. White lithic tuff (Trt) is locally interbedded with the volcanic rocks. Biotite and plagioclase from an andesite flow in this unit yield discordant K-Ar ages of 12.5 and 11.1 Ma, respectively (J.E. Spencer, written commun., 1981). Biotite from a latite flow at the west end of Black Butte, 3 km northeast of the map area, yields a K-Ar age of 13.8 Ma (D.H. Hambrick, written commun., 1988)

Tra Andesite dikes

Trs Sedimentary rocks--Shale with lenses of quartz pebble sandstone overlain by tuff and a lacustrine sequence of interbedded limestone, shale, tuffaceous shale, and siltstone. The sandstone lenses grade eastward into fanglomerate deposits. Burchfiel and Davis (1988) reported that a tuff from this unit yields a K-Ar age of 14.1 Ma

Trb Carbonate-cemented breccia and tuffaceous arkosic sandstone. The breccia includes clasts of Cambrian quartzite, shale, and dolomite up to 8 cm in long dimension

Tfe **Iron veins (middle Miocene)**--Magnetite-hematite veins in the Crystal Spring Formation north of Beck Canyon

Granite of Kingston Peak (middle Miocene)--Hypabyssal gray biotite hornblende granite divided into (youngest first) aplite, quartz porphyry, and feldspar porphyry facies. Rhyolite porphyry dikes and mafic xenoliths are common in the quartz porphyry and the feldspar porphyry facies; aplite dikes and quartz veins are common in all three facies. These rocks were originally mapped as Upper Cretaceous or Lower Tertiary Kingston Range monzonite porphyry by Hewett (1948, 1956) and as Miocene (12.8 Ma) biotite adamellite porphyry by Armstrong (1970)

Tkqv Quartz veins--Generally massive and nonmineralized, locally contain amethyst crystals

Tkap Aplite dikes

Tkrd Rhyolite porphyry dikes

Tkad Andesite dikes

Tka Aplite facies--Fine grained, equigranular aplite that contains 1-2 percent biotite

Tkq Quartz porphyry facies--Very fine grained biotite±hornblende granite porphyry characterized by subhedral to euhedral quartz phenocrysts up to 3 mm across, 6 to 8 percent mafic minerals, and miarolitic cavities. The quartz porphyry facies intrudes the feldspar porphyry facies east of Kingston Peak and grades into the aplite facies along the southern slope of the range; stoped blocks of gray monzogranite from the granite of Rabbit Holes Spring are common along the western flank of the range

Tkf Feldspar porphyry facies--Fine- to medium-grained biotite hornblende granite porphyry characterized by feldspar phenocrysts up to 2 cm long, 4-5 percent mafic minerals, rapakivi textures, and miarolitic cavities. Biotite and hornblende from this facies yield concordant conventional K-Ar ages of 12.1 and 12.4 Ma, respectively; hornblende yields an $^{40}Ar/^{39}Ar$ age of 12.4 Ma

Ts **Syenite of Peak 4611 (Tertiary?)**--Very fine-grained alkali feldspar quartz syenite. Age uncertain but may be older than the granite of Kingston Peak and younger than the granite of Rabbit Holes Spring

TKrd **Rhyolite dikes (Tertiary or Cretaceous)**--Felsic dikes, generally equigranular but locally pegmatitic, that intrude Stirling Quartzite, Johnnie Formation, and gneiss in the Mesquite Mountains

Granite of Rabbit Holes Spring (Cretaceous?)--Roof pendant of the Mesozoic Teutonia Batholith in the granite of Kingston Peak. Includes:

Krgm Gray, medium-grained biotite monzogranite with rare subhedral potassium feldspar phenocrysts up to 6 mm long. Although biotite from this unit yields a K-Ar age of 11.0 Ma, stoped blocks of the gray monzogranite occur in the quartz porphyry facies of the 12.4 Ma granite of Kingston Peak along the west side of the Kingston Range. These intrusive relations suggest that the age of the monzogranite was reset during middle Miocene magmatism

Kftm Tan, medium- to coarse-grained monzogranite; generally equigranular but locally porphyritic along the west side of Fusilinid Hill. Pegmatite dikes (Krp) and autoliths of gray monzogranite are common. Although modally and chemically similar to the Cretaceous Teutonia quartz monzonite, biotite from the this unit yields a K-Ar age of 11.6 Ma; the K-Ar age was reset during middle Miocene magmatism and extensional tectonics

Pal **Miogeoclinal Rocks (Paleozoic and Late Proterozoic)**--Large slide block(s) of undifferentiated Cordilleran miogeoclinal rocks that range in age and composition from Mississippian carbonate rocks to Late Proterozoic Stirling Quartzite

Ꞓn **Nopah Formation (Late Cambrian)**--Massive, coarse-crystalline dolomite, characterized by alternating gray and white bands and minor chert beds and nodules, overlying laminated gray and brown shale and dolomitic siltstone interbedded with stringers of gray mottled dolomite. Hazzard (1937) and Cooper and others (1982) described Late Cambrian trilobites and brachiopods from the Nopah Formation in the southern Nopah Range. The incomplete section of the Nopah Formation in the Blacksmith Hills is 460 m thick

Bonanza King Formation (Late and Middle Cambrian)--Dolomite and limestone divided into the Banded Mountain and the Papoose Lake members. Map patterns of relatively undeformed sections suggest that this formation is 1087 m thick within the map area

Ꞓbb Banded Mountain member--Banded gray and black dolomite and limestone with occasional chert nodules and oolitic dolomite layers or beds. The base of this member consists of thin-bedded grayish orange silty limestone, dolomite, and shale. The shale contains Middle Cambrian *Ehmanin* and *Linguella* trilobites in the Nopah Range (Hazzard, 1937). The remainder of the Banded Mountain member is Late and Middle Cambrian in age (Burchfiel and others, 1982)

Ꞓbp Papoose Lake member--Massive dark gray mottled dolomitic limestone with occasional thin clayey and sandy limestone beds

Ꞓb Undivided Bonanza King Formation

Ꞓc **Carrara Formation (Middle and Early Cambrian)**--Thin- to medium-bedded limestone, limy mudstone, and shale interbedded with silty and(or) calcareous shale. The limestone is generally laminated and locally oolitic; the shale includes micaceous sand or silt lenses and minor quartzite. Regional isopach patterns suggest that the Carrara Formation is 296 m thick in the Kingston Range (Palmer and Halley, 1979). Palmer and Halley reported that the Carrara Formation contains early Middle Cambrian and late Early Cambrian trilobites including *Olenellus*, *Albertella*, and fragments of *Glossopleura*. The Carrara Formation is informally divided into the upper, middle, and lower members northeast of VABM Mesquite

Ꞓcu Upper member--Orange weathered silty limestone and calcareous siltstone with a basal gray limestone marker bed. The percentage of limestone increases upsection. The basal gray limestone is probably equivalent to the Red Pass Limestone member of Palmer and Halley (1979); the overlying calcareous siltstone and limestone are probably equivalent to the Pahrump Hills Shale, Jangle Limestone, and Desert Range Limestone members

Ꞓcm Middle member--Dark maroon shale and siltstone. Probably equivalent to the Pyramid Shale member of Palmer and Halley (1979)

Ꞓcl Lower member--Gray and green silty shale and orange weathered silty limestone that contains pisolites. Probably equivalent to the Eagle Mountain, Echo Shale, and Gold Ace Limestone members of Palmer and Halley (1979)

Ꞓz **Zabriskie Quartzite (Early Cambrian)**--Pale red purple to gray very fine- to medium-grained quartz arenite overlain by red shale and laminated siltstone. The quartz arenite is cross bedded and includes granules and rounded cobles of red chert and white quartz. The top of this formation consists of gray fine- to medium-grained quartz sandstone with poorly developed ripple marks and trough cross bedding. Vertical *Scolithus* tubes are locally developed in the lowest sandstone bed and at the top of this formation. The Zabriskie Quartzite is 42 and 23 m thick in the northern and eastern Kingston Range, respectively (Prave, 1984)

Wood Canyon Formation (Early Cambrian and Late Proterozoic)--Interbedded clastic and calcareous units divided into the upper, middle, and lower members. The Wood Canyon Formation is 454 m thick in the northern Kingston Range (Diehl, 1979)

ꞒZwu Upper member--Massive or wavy cross laminated medium- to coarse-grained feldspathic and micaceous sandstone and quartzite interbedded with siltstone and resistant silica-cemented sandstone. Sandy dolomite lenses in micaceous sandstone become more common upsection. The micaceous sandstone contains abundant *Nevadella* trilobite fragments, brachiopod molds, and *Scolithus* tubes; the dolomite lenses contain echinoderm debris. These rocks are overlain by several cycles of thin siltstone and cross laminated calcareous sandstone, cross laminated dolomitic sandstone, and sandy dolomite capped by finely crystalline dolomite that weathers to a characteristc "elephant-hide" surface. Trilobite fragments, brachiopod molds, and echinoderm debris occur throughout these cycles. The cyclic sequence is overlain by interbedded fissile micaceous siltstone and fine-grained dolomitic or micaceous sandstone that contains trilobite fragments. The upper member is capped by white, medium- to coarse-grained vitreous quartzite

ꞒZwm Middle member--Basal cross-bedded arkosic quartz pebble conglomerate overlain by cyclic sequences of very coarse-grained quartzitic sandstone or pebbly conglomerate, cross bedded coarse-grained feldspathic quartzite, and medium-grained arkosic to feldspathic sandstone capped by massive maroon and purplish red siltstone. *Scolithus* tubes are common near the top of this member

ꞒZwl Lower member--Massive and cross bedded medium- to fine-grained silica cemented sandstone overlain by medium- to very finely-crystalline dolomite. Horodyski (1992) and Horodyski and others (1994) described Early Cambrian trace fossils and Late Proterozoic megafossils from this member in southern Nevada and concluded that the Cambrian-Precambrian boundary occurs within the lower member of the Wood Canyon Formation

ꞒZw Undivided Wood Canyon Formation

Stirling Quartzite (Late Proterozoic)--Sandstone, siltstone, and minor dolomite divided into the upper, middle, and lower members. The Stirling Quartzite is 565 m thick in the northern Kingston Range (Wertz, 1983)

Zsu Upper member--Gray and pink medium- to coarse-grained quartz sandstone with thin interbeds of pinkish to greenish siltstone and shale. The sandstone is characterized by laminar bedding and includes planar cross beds and truncated ripple marks. Pebbly sandstone with subrounded quartz clasts occur near the top of this member

Zsm Middle member--Fining upward cycles of purple, gray, and yellowish brown micaceous siltstone and medium-grained feldspathic sandstone with rare interbeds of yellowish brown silty dolomite

Zsl Lower member--White to brownish red coarse- to fine-grained quartzose, feldspathic, and arkosic sandstone with rare beds of angular quartz boulder conglomerate. The sandstone beds are 1-2 m thick and include planar cross beds with truncated upper surfaces. Well-rounded quartz pebbles are common near the base of this member

Johnnie Formation (Late Proterozoic)--Clastic and carbonate units informally divided into the Rainstorm, middle, and lower members. Benmore (1978) reported that the Johnnie Formation is 386 m thick in the northern Kingston Range.

Zjr Rainstorm member--Maroon, gray, and tan siltstone and shale interbedded with gray dolomite, lilac limestone, and gray fine-grained quartzite near the top of this member. Orange weathered oolitic dolomite near the base of this member is an excellent regional marker bed

Zjm Middle member--Orange, brown, and gray siltstone and micaceous shale interbedded with gray fine-grained sandstone and quartzite lenses and overlain by gray very fine-crystalline dolomite. The dolomite grades upsection into dolomitic quartzite overlain by sandy dolomite and includes occasional graywacke and green siltstone lenses. Altered tuff (Zjt) occurs along the east side of the range

Zjl Lower member--Intercalated lenticular beds of tan and gray fine- to coarse-grained sandstone, gray siltstone, and gray very fine-crystalline sandy stromatolitic dolomite overlain by brown cross-bedded quartz sandstone with a few thin beds of siltstone, sandy dolomite, and quartz or chert pebble conglomerate. Member is capped by gray algal dolomite with seams of black chert. Cloud and Semikhatov (1969) described *Linella* and *Boxonin* stromatolites from the lower member in the southern Nopah Range. Benmore (1978) reported that both stromatolites are indicative of a Vendian (570-675 Ma; Krylov and Semikhatov, 1976) age

Zj Undivided Johnnie Formation

Zn **Noonday Dolomite (Late Proterozoic)**--Laminated pinkish gray and tan very fine-crystalline dolomite with abundant concentrically banded algal mounds overlain by tan sandy dolomite with fewer algal mounds. The banded algal mounds are cut by near-vertical fluid expulsion tubes filled with dolomite, quartz, or clay. The upper mounds are overlain by fine- to medium-crystalline dolomite and quartz sandstone; the abundance of sandstone increases upsection and is gradational into the Johnnie Formation. Red siltstone and orange-weathering dolomite are common between the algal mounds in the northeastern part of the range; erosional clasts of Noonday Dolomite mixed with Ibex Formation (Znb) are present in the southwest corner of the map. The Noonday Dolomite is 240 m thick in the western Kingston Range (Ken Werner, written commun., 1985). Wright and others (1978) reported that banded algal mounds in the Noonday Dolomite at its type locality in the southern Nopah Range resemble Late Riphean (675-950 Ma; Krylov and Semikhatov, 1976) *Dzhelindia* algal mounds

Kingston Peak Formation (Middle Proterozoic)--A thick siliciclastic sequence informally divided into the upper, middle, and the lower members at its redefined type locality northeast of Beck Spring. Susan Hayes (written commun., 1985) reported that the Kingston Peak Formation is 514 m thick at this new type locality; it is 350 m thick north of Crystal Spring (Graff, 1985) and about 3,000 m thick along the eastern flank of the range (B.W. Troxel, unpublished data, 1990). Pierce and others (1977) and Pierce and Cloud (1978) described spheroid, filament-like, and composite nannofossils in oncoids from the Kingston Peak Formation, Beck Spring Dolomite, and the Crystal Spring Formation in the northern Kingston Range and concluded that these nannofossils, as well as algae described by Licari (1978) from the Beck Spring Dolomite, are Middle Riphean (950-1350 Ma; Krylov and Semikhatov, 1976) in age

Yku Upper member--Massive monolithologic megabreccia overlain by interbedded sequences of conglomerate, sandstone, shale, and diamictite. The megabreccia consists of angular, poorly sorted megaclasts of Beck Spring Dolomite (Ykb), Crystal Spring Formation (Ykc), diabase (Ykd), and gneiss (Ykgn) up to 1.5 km long in a green fine-grained sandstone and siltstone matrix. The megabreccia overlies a gray oncolitic cherty dolomite (Ykod) and is overlain by laminated gray green siltstone. The megabreccia grades upsection into interbedded conglomerate, arkosic and pebble sandstone, and laminated siltstone. These clastic rocks thicken and fine to the south where they consist of graded cycles of conglomerate, diamictite, sandstone, and siltstone. Tuff, pumice, and volcanic lithic fragments are interbedded with the megabreccia unit in the eastern Kingston Range. Bedded iron formations occur within the siltstone intervals

Ykm Middle member--Massive dark gray and brown open framework conglomerate with clasts of diabase, Beck Spring Dolomite, Crystal Spring Formation, and gneiss up to 15 cm long in a fine- to medium-grained sandstone or limy mudstone matrix

Ykl Lower member--Massive to thinly bedded green siltstone and fine-grained arkosic sandstone. Siltstone locally includes laminated shale

Yb **Beck Spring Dolomite (Middle Proterozoic)**--Cliff-forming, laminated, gray medium- to coarse-crystalline dolomite that becomes more massive upsection. Finely laminated dolomite in the lower part of this formation includes truncated algal mounds and is overlain by wavy to wrinkled, coarsely laminated dolomite characterized by selectively silicified ooliths and pisoliths. The upper, relatively massive dolomite interval includes abundant chert nodules, rare interbeds of granule sandstone, and lenses of shale. Marian (1979) reported that the Beck Spring Dolomite is 485 m thick at its type locality north of Beck Spring. Cloud and others (1969) recognized six types of filament-like and globular nannofossils in thin sections of silicified stromatolites near the top of the Beck Spring Dolomite east of Horse Thief Springs. Licari (1978) described and named the filament-like algae *Beckspringia* and the most common globular algae *Maculospharera kingstonesis* and *Conglobocella troxelii*

Crystal Spring Formation (Middle Proterozoic)--Conglomerate, arkosic and feldspathic sandstone, siltstone, shale, stromatolitic limestone, dolomite, and chert divided into the upper, middle, and the lower members. The Crystal Spring Formation is 1,210 m thick at its type locality near Crystal Spring (Roberts, 1976; Maud, 1979). Unfortunately, the lower member is in fault contact with gneiss at the type locality. Roberts (1974) described a depositional contact between gneiss and the lower member west of the Excelsior Mine. Here, the lower member is thinner than at its type locality; however, all units of the Crystal Spring Formation are present in the same stratigraphic sequence

Ycu Upper member--Five laminated dolomite intervals divide this member into six clastic units of gray and brown siltstone interbedded with gray fine- to coarse-grained quartzitic or arkosic sandstone. The gray very fine- to coarse-crystalline dolomite contains unique algal structures and locally oncolithic chert beds or nodules. The sandstone generally becomes more arkosic and coarser grained upsection; rare beds of green chert conglomerate occur near the base of this member

Ycm Middle member--Coarsening-upward sequence of siltstone and shale, calcareous quartzose sandstone, and impure shaly limestone that grades into cycles of gray and brown very fine-crystalline dolomite alternating with intebedded gray siliceous dolomite and brown chert. The siltstone, sandstone, and limestone sequence is metamorphosed to metasiltstone and calc-silicate rocks near contacts with diabase sills. Talc-tremolite zones (Yt) occur in dolomite near intrusive contacts with diabase. The dolomite cycles are overlain by algal limestone with cycles of morphologically different stromatolites. The top of the carbonate-chert member is marked by variegated massive chert characterized by brown, dark red, and black bands. Roberts (1982) reported that the algal limestones contain *Conophyton* and *Baicalia* stromatolites. The coexistence of these stromatolites is considered a typical Middle Riphean assemblage (Walter, 1972)

Ycl Lower member--Basal conglomerate and cycles of cross bedded pale green conglomerate and arkosic sandstone overlain by cross bedded feldspathic sandstone. The basal conglomerate consists of pebble to boulder clasts of white quartz, metaquartzite, and gneiss in a very coarse-grained feldspathic sandstone and arkose matrix. The feldspathic sandstone consists of red to purple, fine- to coarse-grained sandstone with shale partings grading upsection into fining upward cycles of sandstone, siltstone, and shale. The top of this member is marked by massive purple or red silty to sandy mudstone

Yc Undivided Crystal Spring Formation

Yd **Diabase (Middle Proterozoic)**--Dark green medium-grained (locally fine- and coarse-grained) ophitic to subophitic diabase sills and dikes in the Crystal Spring Formation and gneiss. Abundant deuteric alteration minerals constitute 50-80 percent of the rock and include sausseritized plagioclase, hornblende, actinolite, epidote, sericite, biotite, and chlorite. Chlorite and an unidentified secondary mineral with rims of amphibole fibers form pseudomorphs after olivine. The diabase sills in the Kingston Range range from 10 to 270 m thick. Baddeleyite from a diabase sill near Beck Spring yields a U-Pb age of 1,087±3 Ma (Heaman and Grotzinger, 1992)

Xgn **Gneiss (Early Proterozoic)**--Pink coarse-grained micaceous granitic gneiss cut by numerous pegmatite dikes and milky quartz veins. Granitic gneiss in the Kingston Range is characterized by quartz and feldspar porphyroblasts; brecciated gneiss at Horse Thief Springs contains blue amphibole. Green schist occurs with granitic gneiss west of Jupiter Hill. Mylonitic gneiss in the Mesquite Mountains occurs within low-angle shear zones and is gradational into quartzofeldspathic gneiss. Stratigraphic and geochronologic data indicate that gneiss in the Kingston Range is older than the Crystal Spring Formation and may be equivalent to 1,790 Ma augen gneiss (Lanphere and others, 1964) in the Panamint Mountains 110 km west of the Kingston Range. The abundance of 1700^+ Ma pegmatites that cut gneiss and schist in the Mesquite Mountains (Lanphere, 1964) and in the Kingston Range suggests that gneiss in the Kingston Range is Early Proterozoic in age

REFERENCES CITED

Armstrong, R.L., 1970, Geochronology of Tertiary igneous rocks, eastern Basin and Range province, western Utah, eastern Nevada, and vicinity, U.S.A.: Geochemica et Cosmochimica Acta, v. 34, p. 203-232.

Bell, R.E., 1971, Geology of the Shadow Mountains area, eastern San Bernardino County, California: San Diego, California State College M.S. thesis, 47 p.

Benmore, W.C., 1978, Stratigraphy, sedimentology, and paleoecology of the late Paleophytic or earliest Phanerozoic Johnnie Formation, eastern California and southwestern Nevada: Santa Barbara, University of California Ph.D. dissertation, 243 p.

Berggren, W.A., Kent, D.V., Flynn, J.J., and Van Couvering, J.A., 1985, Cenozoic geochronology: Geological Society of America Bulletin, v. 96, p. 1407-1418.

Burchfiel, B.C. and Davis, G.A., 1988, Mesozoic thrust faults and Cenozoic low-angle normal faults, eastern Spring Mountains, Nevada, and Clark Mountains thrust complex, California: *in* Weide, D.L. and Faber, M.L., eds., This extended land, Geological journeys in the southern Basin and Range: Geological Society of America, Cordilleran Section, Field Trip Guidebook, p. 87-105.

Burchfiel, B.C., Hamill, G.S., and Wilhelms, D.E., 1982, Stratigraphy of the Montgomery Mountains and the northern half of the Nopah and Resting Springs Ranges, Nevada and California: Geological Society of America Map and Chart Series MC-44, scale 1:62,500.

Cloud, P.E., Jr., and Semikhatov M.A., 1969, Proterozoic stromatolite zonation: American Journal of Science, v. 267, p. 1017-1061.

Cloud, P.E., Jr., Licari, G.R., Wright, L.A., and Troxel, B.W., 1969, Proterozoic Eucaryotes from eastern California: National Academy of Sciences, Proceedings, v. 62, p. 623-630.

Cooper, J.D., Miller, R.H., and Sundberg, F.A., 1982, Environmental stratigraphy of the lower part of the Nopah Formation (Upper Cambrian), southwestern Great Basin: *in* Cooper, J.D., Troxel, B.W., and Wright, L.A., eds., Geology of selected areas in the San Bernardino Mountains, western Mojave Desert, and southern Great Basin, California: Geological Society of America, Cordilleran Section, Guidebook and Volume, p. 97-116

Diehl, P.E., 1979, The stratigraphy, depositional environments, and quantitative petrology of the Precambrian-Cambrian Wood Canyon Formation, Death Valley: Pennsylvania State University Ph.D dissertation, 365 p.

Friedmann, S.J., 1993, High precision radiometric dates from the Miocene Shadow Valley basin, southern California: Preliminary rates: Geological Society of America Abstracts with Program, v. 25, p. 39.

Graff, D.A., 1985, Paragenesis of iron formation within the Kingston Peak Formation, southern Death Valley, California: Davis, University of California M.S. thesis, 170 p.

Hazzard, J.C., 1937, Paleozoic section in the Nopah and Resting Springs Mountains, Inyo County, California: California Journal Mines and Geology, v. 33, p. 289-339.

Heaman, L.M., and Grotzinger, J.P., 1992, 1.08 Ga diabase sills in the Pahrump Group, California: Implications for development of the Cordilleran miogeocline: Geology, v. 20, p. 637-640.

Hewett, D.F., 1948, Iron deposits of the Kingston Range, San Bernardino County, California: California Division of Mines and Geology Bulletin 129, p. 195-206.

Hewett, D.F., 1956, Geology and mineral resources of the Ivanpah Quadrangle, California and Nevada: U.S. Geological Survey Professional Paper 275, 172 p.

Horodyski, R.J., 1992, Late Proterozoic megafossils from southern Nevada: Geological Society of America Abstracts with Program, v. 23, p. A163.

Horodyski, R.J., Gehling, J.G., Jensen, Soren, and Runnegar, Bruce, 1994, Ediacara fauna and earliest Cambrian trace fossils in a single parasequence section, southern Nevada: Geological Society of America Abstracts with Program, v. 26, p. 60.

Krylov, I.N., and Semikhatov, M.A., 1976, Table of time-ranges of the principal groups of Precambrian stromatolites: *in* Walter, M.R., Stromatolites: Amsterdam, Elsevier Scientific Publishing Company, p. 693-694.

Lanphere, M.A., 1964, Geochronologic studies in the eastern Mojave Desert, California: Journal of Geology, v. 72, p. 381-399.

Lanphere, M.A., Wasserburg, G.J.F., and Albee, A.L., 1964, Redistribution of strontium and rubidium isotopes during metamorphism, World Beater Complex, Panamint Range, California: *in* Craig, H., Miller, S.L., and Wasserburg, G.J., eds., Isotopic and cosmic chemistry: Amsterdam, North Holland Publishing Co., p. 269-320.

Licari, G.R., 1978, Biogeology of the late pre-Phanerozoic Beck Spring Dolomite of eastern California: Journal of Paleontology, v. 52, p. 767-792.

Marian, M.L., 1979, Sedimentology of the Beck Spring Dolomite, eastern Mojave Desert, California: University of Southern California M.S. thesis, 215 p.

Mason, J.F., 1948, Geology of the Tecopa area, southeastern California: Geological Society of America, v. 59, p. 333-352.

Maud, R.L., 1979, Stratigraphy and depositional environments of the carbonate-terrigenous member of the Crystal Spring Formation, Death Valley, California: Pennsylvania State University M.S. thesis, 177 p.

Palmer, A.R., and Halley, R.B., 1979, Physical stratigraphy and Trilobite biostratigraphy of the Carrara Formation (Lower and Middle Cambrian) of the southern Great Basin: U.S. Geological Survey Professional Paper 1047, 131 p.

Pierce, David, and Cloud, P.E., Jr., 1978, New microbial fossils from ~1.3 billion-year-old rocks of eastern California: Geomicrobiology Journal, v.1, p. 295-309.

Pierce, David, Cloud, P.E., Jr., Troxel, B.W., and Wright, L.A., 1977, New microfloras from the Pahrump Group, later pre-Phanerozoic, eastern California: Geological Society of America Abstracts with Program, v. 9, p. 481-482.

Prave, A.R., 1984, Stratigraphy, sedimentology, and petrography of the Lower Cambrian Zabriskie Quartzite in the Death Valley region, southeastern California and southwestern Nevada: Pennsylvania State University M.S. thesis, 193 p.

Roberts, M.T., 1974, The stratigraphy and depositional environments of the lower part of the Crystal Spring Formation, Death Valley, California: Pennsylvania State University Ph.D dissertation, 248 p.

Roberts, M.T., 1976, Stratigraphy and depositional environments of the Crystal Spring Formation, southern Death Valley region, California: California Division of Mines and Geology Special Report 106, p. 49-57.

Roberts, M.T., 1982, Depositional environments and tectonic setting of the Crystal Spring Formation, Death Valley region, California: in Cooper, J.D., Troxel, B.W., and Wright, L.A., eds., Geology of selected areas in the San Bernardino Mountains, western Mojave Desert, and southern Great Basin, California: Geological Society of America, Cordilleran Section, Guidebook and Volume, p. 143-154

Scott, R.K., 1985, Stratigraphy and depositional environments of a Neogene playa-lake system, China Ranch beds, near Death Valley, California: Pennsylvania State University M.S. thesis, 240 p.

Wertz, W.E., 1983, The depositional environments and petrography of the Stirling Quartzite, Death Valley region, California and Nevada: Pennsylvania State University Ph.D dissertation, 192 p.

Walter, M.R., 1972, Stromatolites and the biostratigraphy of the Australian Precambrian and Cambrian: The Palentological Association, London, Special Papers in Paleontology, n. 11, 190 p.

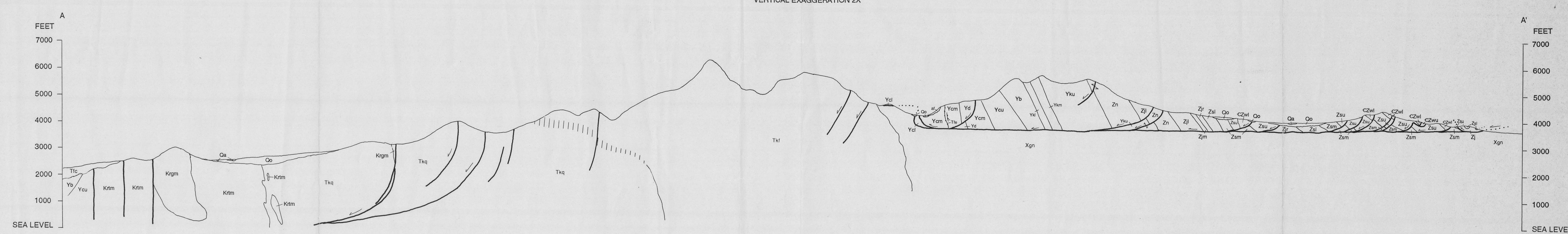
Wright, L.A., 1954, Geology of the Alexander Hills area, Inyo and San Bernardino Counties: in Geology of Southern California, California Division of Mines Bulletin 170, Map Sheet 17, scale 1:24,000.

Wright, L.A., 1968, Talc deposits of the southern Death Valley-Kingston Range region, California: California Division of Mines Special Report 95, 79 p.

Wright, L.A., 1974, Geology of the southeastern quarter of the Tecopa Quadrangle, Inyo County, California: California Division of Mines and Geology Map Sheet 20, scale 1:24,000.

Wright, L.A., Williams, E.G., and Cloud, P.E., Jr., 1978, Algal and cryptalgal structures and platform environments of the late pre-Phanerozoic Noonday Dolomite, eastern California: Geological Society of America Bulletin, v. 89, p. 321-333.

VERTICAL EXAGGERATION 2X



VERTICAL EXAGGERATION 2X

GEOLOGIC MAP OF THE KINGSTON RANGE, SOUTHERN DEATH VALLEY, CALIFORNIA

By

J.P. Calzia, B.W. Troxel, L.A. Wright, B.C. Burchfiel, G.A. Davis, and M.R. McMackin

2000